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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
NOI Docket MM 93-225	)	MM 93-225
	)	
Improvement of broadcast aural modulation standards.	)	
	)	
November 2, 1993	)	

by Edward Y. Wright, WXXI, P.O. Box 21, Rochester, NY 14601

I, Edward Y. Wright, have served professionally in the broadcasting industry in various capacities in AM, FM and TV since 1964. Specific to these issues I have worked for 4 FM stations and 3 TV stations. I have been responsible for setting modulation levels and performing proof of performances.

The questions the Commission asks today are timely, given the advances in the sate-of-the-art and difficulties broadcast engineers are having determining proper modulation levels under existing rules.

In summary, I recommend that the Commission:

(1) apply current research data to the problem of preventing FM interference;

(2) this would particularly address peak levels, including those produced by processing techniques, transmitter exciter overload, and STL overload;

(3) determine reasonable design assumptions for headroom in home receivers;

(4) provide broadcast engineers with the tools to establish proper operating levels; this could include a synthesized test source material, to be run through station processing equipment, and an FCC tested and certified modulation measuring device with a simple calibrating technique that gives a digital readout of FCC peak weighted modulation during the sample period.

Cases:

I should point out that Tektronix, of Beaverton, Oregon, faced a similar problem of determining proper display of modulation levels on their model 951 stereo TV demodulator. (This is apparently footnote #11 in the FCC's NOI). We were among the first to receive the unit, and because its display was entirely based on peak readings, our station was considerably less loud than other stations. Two other electronic devices gave us readings showing that we were considerably low in modulation. During the interim period, while we waited for a new board and software from Tektronix, I adjusted our TV stereo modulation to match non-stereo, moderate level stations in my market. When the new board

came, I was found to be about 1 dB low. During that time the Tek was occasionally reading in excess of 160%, and a Marcom modified TFT 701 was rarely hitting 50%.

Similarly, in FM, I have found that although both the TFT and Belar modulation monitors report 100% modulation at a given Bessel null, other frequencies indicate a variance of 1 dB on the units I have. Of greater importance, their reaction to program peaks shows a difference of 2 dB. We have added a Belar Wizard to our arsenal of confusion, but it can be adjusted to agree with either.

The above cases illustrate the frustration the broadcast engineer has with FM modulation measurement. What I would like would be a set of rules that tells me what modulation levels are allowed, and an instrument that gives me simple numbers.

Use of Spectrum Analyzer:
A spectrum analyzer has been suggested. Since I have frequently been working for a public joint FM-TV licensee, I have had a spectrum analyzer available to me. Other than the Bessel null, I have not found a spectrum analyzer particularly useful for FM modulation determination on program material, again because of the difficulty determining peak modulation. In the case of TV transmission via satellite (FM), I do not believe that a spectrum analyzer, looking at program modulated energy is sufficiently accurate to provide reasonable video levels to receiving sites. The display just goes smoothly into the noise. From what I have seen on program material on a Tektronix 7L12 spectrum analyzer, there is no way to set level using a spectrum analyzer.

Proposal:
Thus, despite the Commission's stated intent not to return to type approving equipment I feel that they must do so or provide a uniform test procedure to determine an accurate and repeatable -- regardless of model or manufacturer -- measurement on specific program material. Having had to set up audio processors on various types of program material, it is obviously not enough to be repeatable on constant tones -- the instruments must correlate on program material.

Therein lies the suggestion that the Commission's engineering staff, through research, develop a synthesized test signal sequence that can be made available on CD (compact disc) or other suitable means that will synthesize audio waveforms that will provide worse-case interference causing potential. The commission's lab could then use this to illustrate a correlation between measuring instruments. In the field, broadcast engineers find it necessary to adjust their processing equipment to the "worst" of a variety of program signals. One of my favorite program signal sources is the metallic sound of the harpsichord. The complex waveform thus generated usually forces me to "back off" the output level of

my processor at the last stage to the transmitter. There is likely a similar complex high frequency and high peak sound in other program formats. This program input, combined with FM's pre-emphasis curve pushes most equipment beyond 100% modulation. Further consideration needs to be made for a station transmitting a variety of subcarrier technologies. How often should the simultaneous sum of all modulations extend beyond the assigned bandwidth? Has interference criteria been established?

If the Commission's own present measurement procedure were adapted (that of using a communications receiver and an oscilloscope with vertical deflection calibrated to 100%), then we would be -- as is the Commission's field staff -- all saddled with the subjective evaluation as to when is anything over 100% too much? And too often? Should the main channel and sub channels be evaluated separately or together? These are answers that must be answered based on interference research. That FCC field engineers I have spoken to only cite the most obviously offending stations only illustrates the unmanageability of such a "purist" approach. This approach might actually be the cheapest for the station -- to attach a scope to the composite output of a modulation monitor, provide a reference 100% calibrating signal, and then watch the modulation with several types of program material. I've used this technique, and I sympathize with the Commission's field inspectors' problem of interpreting the results.

A key interference question is: Is it true that the nature of FM detection allows energy from adjacent channels to incur into the bandwidth of the carrier being received for brief periods and results in no bad effects? Even if so, we should not significantly alter our present modulation standards. On the one hand, higher modulation could cause overloading of older transmitters and receivers, and it ultimately may cause more interference. Another approach would be better, more content adaptive processors, that would compensate for pre-emphasis, try to maintain some dynamic range, and allow no waveform to pass a certain point (without generating splatter (distortion)) would allow a very simple peak detector to be used.

<u>In conclusion,</u> I urge the Commission to move forward with data collection and research to answer the three basic initial questions of this comment. Further, when that's done, give manufacturers a standard to build to. Develop a synthesized worst-case CD that can be played anytime modulation needs adjustment. Give broadcast engineers an instrument with a simple display and give the engineer a specific simple number to work to, not something requiring subjective judgement or user adjustment.

Edward y. Wright